

**COSIMENA Clusters of Scientific Innovation in the Middle East and North Africa****Water Cluster****“Water Resource Management” and “Water, Energy, Food and Ecosystem Nexus (WEFE)”****Monday, November 23rd****LONG REPORT**

“It is of no doubt that the Middle East and North Africa belong to the most water poor regions in the world and the most to be at risk of water scarcity,” Ms. Isabell Mering, director of the DAAD Regional Office Cairo, stated in her opening remarks for the public lecture “Water resource management” and “Water, Energy, Food and Ecosystem Nexus (WEFE)” organized by the DAAD Egypt. On Monday, 23<sup>rd</sup> November 2020, experts from the countries of Egypt, Tunisia, Jordan and Germany were invited to share their knowledge on the topics on the agenda from a variety of perspectives. The event included presentations on the technique of water desalination and wastewater treatment by Prof. Ahmed Saad Gomaa, on renewable energies in the Arab region by Prof. Dr. Ahmed Salaymeh, on the specific method of monitoring and forecasting drought through earth observation data by Dr. Moncef Bouaziz and on the project Sigma Nexus in the Mediterranean Area by Dr. Maria Vrachioli. In addition, the participants were offered the opportunity to pose questions to the speakers at the end of each presentation. Equally, the public lecture concluded with a dedicated Q&A time characterized by a rich exchange among the event’s attendees.

After the introductory speech by DAAD director, Ms. Isabell Mering, outlining the relevance of the topic of water resource management for the Middle East and North Africa region, the public lecture began with a detailed presentation titled “Smart and Patterned Membranes for Water Desalination and Wastewater Treatment”. Prof. Ahmed Saad Gomaa from the Egypt-Japan University of Science & Technology shared precise information on the different methods to face the issue of water scarcity such as desalination and wastewater treatment. After emphasizing the challenges in terms of water resource management for Egypt, which ranks 8<sup>th</sup> out of 165 nations in the Water Security Risk Index, Prof. Saad Gomaa explained the details of the water desalination process. Particularly, the desalination process requires a good equipment including specific tools and a solar energy laboratory for the membrane distillation. While defining the fundamental concepts involved into the desalination process such as the term of membrane and classifying the different kinds of techniques, Prof. Saad Gomaa elucidated the nature of his work. Notably, the process of desalination rests on the use of membranes. It involves crucial stages such as testing the membranes through cross flow filtration and then testing how the membranes behave in reaction to the water. Different methods can be applied such as Micro-imprinting and Nano-imprinting and different membranes are used depending on the stage of the process. For example, his team uses Isotropic membranes to treat oily wastewater. Dr. Saad Gomaa concluded by highlighting the advantages of the aforementioned processes for addressing the problem of water scarcity in addition to thanking all funding organizations for their support, including the DAAD. During the Q&A time, he further clarified some details of his work, such as the use of real seawater samples only for the oil fields while using synthesized samples for the desalination membranes.

The public lecture then moved to the topic of renewable energies in the Arab region. Dr. Ahmed Sulaymeh from the University of Jordan shared his expertise in the field of renewable energy and energy regulation through a rich presentation titled “MENA renewables status”. He started by providing an overview of the Arab regional context in terms of energy. Noticeably, the Arab region is characterized by a centralized power market structure and heavy involvement of the public sector in most activities, including generation, transmission and distribution of energy. Although some Arab countries have recently allowed the private sector to acquire licenses, the involvement of the private sector in the provision of energy remains limited with only some exceptions like in the case of Morocco, Jordan and the United Arab Emirates. Moreover, he deplored the scarce diffusion of renewable energy in the region despite the abundant presence of renewable resources. Particularly, he highlighted that most Arab countries have considerable potential for solar power and that CSP technologies alone could generate a hundred times more electricity in the MENA region than the electricity consumption of the Arab region and Europe combined. He equally underlined the current efforts in certain countries like Jordan, Tunisia, Lebanon, Morocco, Palestine, Cyprus and Turkey in the exploration and implementation of innovative solutions. Most notably, the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) has intensely worked since 2017 to install solar water heaters (SWH). Despite some developments, fundamental challenges exist. Among others, Dr. Sulaymeh described the difficulties at the political, legal, regulatory and institutional levels as well as under the economic, financial and institutional aspects. Further, challenges in terms of human and institutional capacity, technology and infrastructure should be taken under consideration. In light of this unfavourable context, Dr. Sulaymeh identified some necessary actions for an effective improvement in the field of renewable energy in the region. They include conducting studies to reduce investment risks and enhance private-sector involvement, developing regional standards certification and quality frameworks for renewable energy systems as well as sharing expertise in this field. In the final Q&A time, Dr. Sulaymeh further emphasized the urgency for Arab countries to invest in developing renewable energy using the existing renewable resources at disposal. Especially, he brought up the positive examples of Morocco and Jordan, which stand in contrast with other countries such as Egypt, where the governmental provision of subsidies for energy represents a major challenge for seriously taking the direction of renewable energies. Additionally, Dr. Sulaymeh shared his concerns on the impact of COVID-19 on this field. In a successive interview, he explained the emergence of other priorities in the current global pandemic context, which undermines investment in the development of renewable energies even in countries like Jordan.

The following speaker focused on a peculiar method available to monitor and forecast drought. Dr. Moncef Bouaziz from l’Ecole Nationale d’Ingenieurs de Sfax in Tunisia explained the potential of earth observation data in predicting drought during his presentation named “Drought monitoring and forecasting based on earth observation data”. Initially, he explained the traditional difficulties in monitoring drought and environmental problems due to high costs and long times of fieldwork. For this reason, earth observation data represents an innovative approach as it allows researchers to gather much information in rapid time and on a vast scale. Notably, earth observation data can monitor phenomena in a variety of areas involving disasters, energy, climate, weather, ecosystem, agriculture, biodiversity and water. Depending on the type of data collected, earth observation offers different types of information on environmental phenomena. For example, optical data are useful for identifying hydrological aspects as they cover small areas at high resolution while the T element data helps to assess precipitation levels and possible droughts. Furthermore, Dr. Bouaziz described his project, which studies the drought impact on the larger ecosystem. Notably, the study focuses on a

small region and uses the Standardized Precipitation Index according to the United Nations standards. The project involves innovative technologies and it is based on a novel machine-learning algorithm for forecasting. As a result, the team group could find close similarity between all models used in predicting drought in that specific case study. Therefore, Dr. Bouaziz could show through this example how earth observation data represent powerful tools to predict drought and study the ecosystem. In the following Q&A time, Dr. Bouaziz clarified the utility of the study, which is limited to the prediction of and adaptation to the drought rather than its reversal and prevention. Moreover, he emphasized the ability of this method in predicting the intensity of precipitations and the ambition to extend the timeframe of prediction to more than one year. In a successive interview, Dr. Bouaziz scrutinized the socio-economic impact of droughts, highlighting the current focus of his research in assessing it through surveys to local farmers in Tunisia. Notably, it is observable a change in the methods and types of cultivations combined with the emergence of new techniques to collect and save water to face expected periods of water scarcity. In some conclusive remarks, he reaffirmed his concerns about the water scarcity problems which the region will face in the future.

The final intervention moved to the analysis of the linkage between water, energy, food and ecosystem. Dr. Maria Vracholi from the Technical University of Munich in Germany first provided an overview of the role of water in the current global context and then presented “the WEF E Nexus in the Mediterranean Area”. Most importantly, she emphasized the necessity to take the quality of water under consideration in addition to its quantity. She equally identified some characteristics specific to water which make it a precious element not to be wasted. Among others, water is characterized by mobility and its property rights are difficult to track. In addition, the unbalance between supply and demand causes the problem of water scarcity, which affects different fields such as agriculture and industry, but not only. Dr. Vracholi presented also some alarming data indicating severe water scarcity problems by 2040 especially in North African countries. On this basis, the Sigma Nexus project was created in an attempt to provide sustainable innovative solutions for the Mediterranean Area while considering the socio-economic and environmental challenges deriving from water scarcity. Operating in different areas of Egypt and Greece, the project involves the achievement of some of the Sustainable Development Goals (SDG) such as ending hunger, ensuring availability and sustainable management of water and sanitation for all, ensuring access to affordable, reliable, sustainable and modern energy for all, conserving and sustainably using the Oceans, Seas and Water Resources as well as protecting, restoring and promoting sustainable use of terrestrial ecosystems. Dr. Vracholi explained the utility of WEF E in different areas, namely agriculture. She equally explained the process of evaluating and assessing trade-offs involving energy production, industry and urbanization, primary production and environmental services. Dr. Vracholi finally concluded by defining Nexus approaches as useful tools to clarify risks and options for sustainability planning, which should simplify complexity and should remain centred around the crucial element of water. Before moving to the Q&A time, Dr. Vracholi introduced the idea of the first Mediterranean WEF E-NEXUS Conference planned for March 2021, which aims to promote the WEF E Nexus Knowledge in the Mediterranean under the aspects of governance, innovations and novel approaches.

In the final part of the public lecture, the attendees and speakers engaged into a brief exchange where further aspects of the topic under discussion were approached. In the context of prediction of drought, Dr. Bouaziz highlighted the need to find adaptive solutions, which should rest on the primordial condition of changing human behaviour to nature by respecting, loving and preserving it.

In conclusion, the online public lecture offered all attendees the opportunity to discuss a topic of primary importance in the current global context from various perspectives. Through the study of the processes of desalination and wastewater treatment, to the analysis of the current status of renewable

energies in the MENA region, to the explanation of the use of earth observation data to predict drought up to the presentation of a socio-economic perspective to the topic of water and the Sigma-Nexus process, the public lecture brought to light the numerous interconnections between all fields of studies in the context of water resource management. Equally, it comprehensively outlined available solutions to the problem of water scarcity taking into consideration the larger ecosystem in which humans live in.

Author : Veronica Merlo